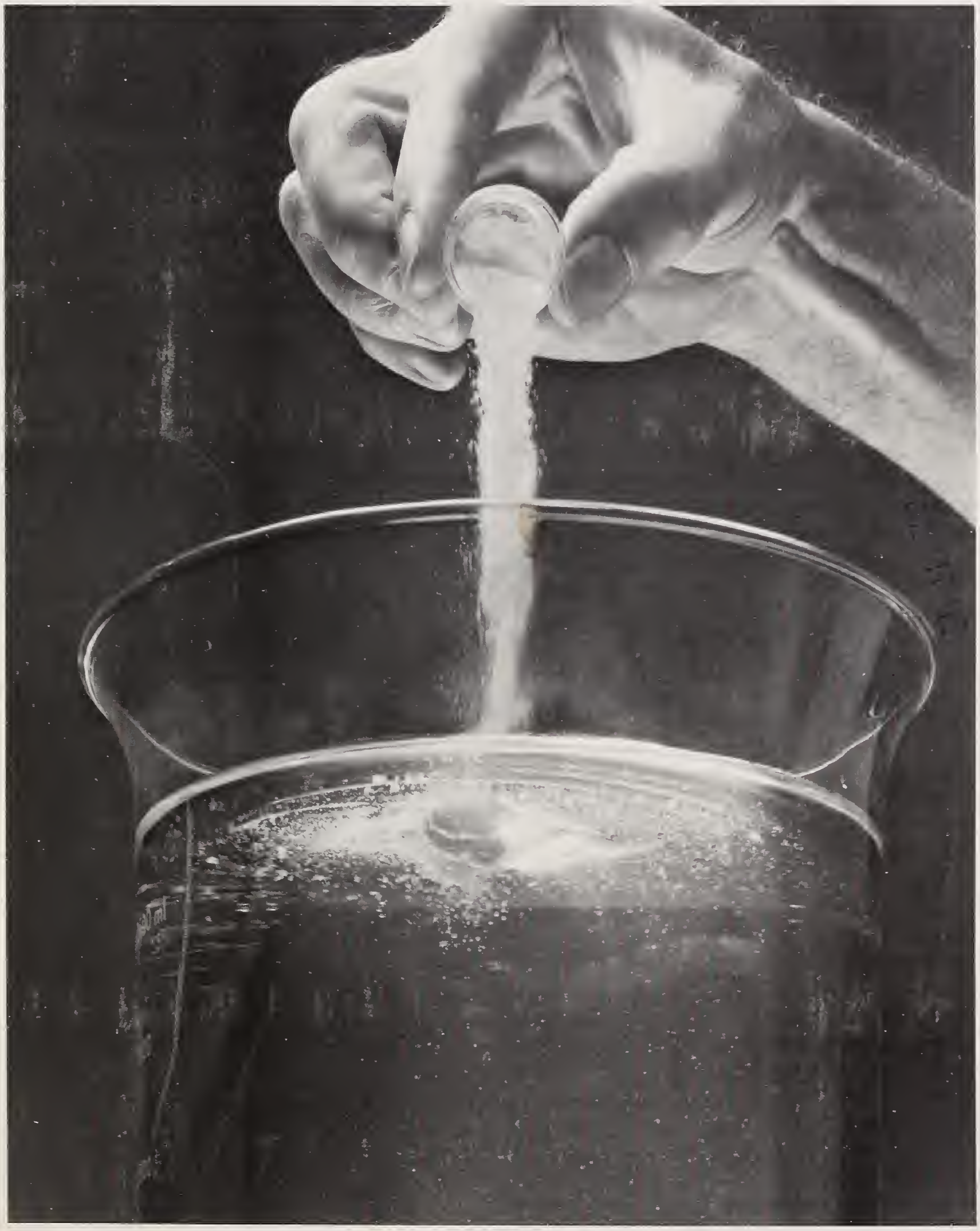
agricultural research

U.S. DEPARTMENT OF AGRICULTURE JUNE 1975



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June 1975/Vol. 23, No. 12

Food of the Multitudes

Rice is mankind's premier food. It is the dietary staple of over half the world's people, many of whom eat it at every meal. No crop is more revered in the crowded underdeveloped nations, where elemental existence demands that every available bit of land be tilled. Indeed, the words *rice* and *food* are synonymous in many Asian languages, reflecting that this grain held a central place in the life of the Oriental peoples millenia before they carried rice beyond its ancestral home.

So important is rice in human destiny that school children everywhere are familiar with pictures of the primitive method of rice culture, for example, a plodding water buffalo pulling a wooden plow through a mucky paddy. Other pictures show the season-long toil of families as they plant seed, transplant seedlings, irrigate, weed, then harvest and thresh the golden grain. When the growing cycle is completed, everyone joins in a time of community celebration.

Far different scenes prevail in the U.S. "rice bowl" regions. Rice culture has reached its highest development since coming to our shores in the late 1600's, probably via Madagascar. Here giant tractors replace men and buffalos to smooth fields and build levees. Our rice is direct-seeded, either by drill or broadcast by aircraft. Airplanes fertilize and weed the crop. Although U.S. growers currently produce about 1.6 percent of the world's rice crop, enough is left after satisfying domestic needs to make us the No. 1 rice-exporting nation.

Our real contribution, however, lies not in rice exports but in the fund of knowledge amassed by our growers and scientists. For example, over the years ARS scientists and their colleagues of State Experiment Stations have been developing varieties that withstand many of the races of rice blast disease, a global problem. They are breeding varieties with shorter and stiffer straws to resist lodging after fertilizer applications. They are also breeding varieties that respond better to and make more efficient use of fertilizer. An important effort is underway to raise the protein content of brown or unmilled rice from its present 7.5 percent to 9.5 percent. Achieving this goal would increase the total protein of rice by 25 percent, a boon to protein-short nations.

All ARS technology, germ plasm, and know-how are shared via widely varied contacts with colleagues at home and abroad. Through these joint efforts, agricultural science will further enhance the well-being of the slender stalk and its burden of harvest—rice, that ancient yet enduring food of mankind.

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COVER: The third generation of a family of water-absorbing starch products works alchemy—it absorbs up to 2,000 times its own weight of distilled water. Over 50 potential applications of the product, dubbed "super slurper," have been proposed by scientists and industries around the world (N62138). Article begins on page 7.

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U. S. Department of Agriculture

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The number of Caribbean fruit flies present on this grapefruit after it was removed from an infestation chamber indicates the fly's attraction to grapefruit for oviposition (1174X1735-31).

Quick action saves Florida grapefruit exports

Inside an infested grapefruit, a fruit fly larva develops in the pulp of the fruit (PN-2879).

THANKS to quick research action, some 6.5 million cartons of Florida grapefruit will find a home in Japan this year.

During the spring and early summer of 1974, larvae of the Caribbean fruit fly were found in shipments of grapefruit from Florida destined for Japan. Not wanting to risk introduction of the Caribfly, Japanese authorities rejected the shipments and would allow no more to enter without assurances that the fruit would be free of Caribfly larvae.

The Japanese grapefruit market, worth some $20 million, has accounted for about a third of the Florida crop.

ARS scientists were asked to help in an effort to develop data on fumigation effectiveness, techniques, and methodology. Specifically, they were to test various time-temperature-dosage conditions for effectiveness in killing larvae prior to shipment.

The scientists had to achieve a 100-percent kill of larvae, fumigation of 300

Mr. von Windeguth places plastic tubes between the boxes of grapefruit in the fumigation van to measure gas distribution of the fumigant within the test chamber (1174X1737–5).

Research entomologist Donald L. von Windeguth and research assistant Frank Cavaliere load infested grapefruit into an experimental fumigation chamber (1174X1737–20).

trucks (300,000 cartons or one ship load) in a 72-hour period, satisfy requirements of various State and Federal regulatory agencies—and have everything ready to roll by the beginning of the 1975 shipping season which got into full swing in February.

ARS scientists at the Subtropical Horticulture Research Station, Miami, Fla., were responsible for this commodity treatment research effort. They worked closely with research personnel of the University of Florida Institute of Food and Agricultural Sciences.

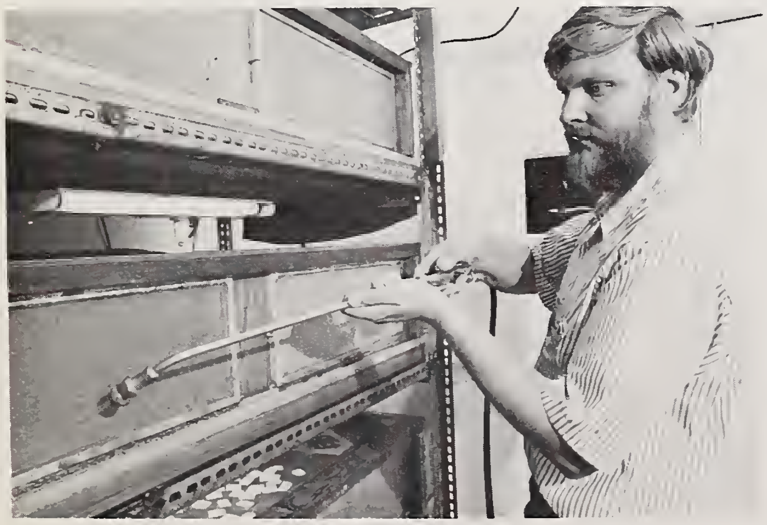
One of the first items of business was to develop a method for infesting fruit with Caribflies to serve as "guinea pigs" for testing fumigation treatments. Fruit flies laid eggs in grapefruit, which were held at room temperature for 4 to 6 days to allow eggs to hatch and larvae to develop. Boxes of infested grapefruit were then loaded into a trailer, sealed, and fumigated. Fruit was stored at room temperature and the number of surviving larvae were counted at 6, 12, and 18 days after treatment.

Results indicate success of the technique. Larvae kills were at the 100-percent level, there was no fruit damage due to fumigation, and all other criteria were met.

The portable fumigation unit used in these tests was developed and supplied by the Florida State Department of Agriculture and Consumer Services, Division of Plant Industry. In practice, 20 of these blower units will be put into service—10 in an area to serve Port Tampa and 10 in the vicinity of Ft. Pierce to serve Port Everglades.

While application of these fumigation studies will take care of the immediate problem, additional research is either proposed or in progress to find solutions for the future. These include: suppression of the fly population using the sterile male technique, ultra-low volume field spraying, biological control using parasites, or attraction using baits, lures or pheromones; as well as alternatives to fumigation such as controlled atmosphere storage, long-term cold storage, gamma irradiation, vacuum fumigation, vapor heat, and various combinations of methods. □

Above: *Attaching the compressed air propellent (foreground) to the injection cylinder, Mr. von Windeguth prepares to inject the fumigant, ethylene dibromide, into the experimental fumigation chamber (1174X1736–9).* ***Below:*** *Because Florida's grapefruit crop did not contain enough fruit fly larvae to be effectively used in the fumigation studies, ARS researchers developed their own breeding grounds for the flies. Biologist John B. Owens washes eggs from the side of one of the rearing cages (1174X1734–29).*



During the fumigation, biological technician William F. Reeder uses a syringe to take a sample of the fumigant from the chamber. A comparative analysis of each sample is made to insure equal distribution of the fumigant within the load (1174X1735–19).

Left: *To check the effectiveness of the fumigation, the grapefruit are stored in sealed trailers for up to 4 weeks after fumigation. Surviving larvae collect in sand-filled boxes beneath the storage cages. Research assistant Cora Lee Crandall sifts the sand checking for larvae and pupae (1174X1733–8).*

Sugarcane breeding

Controlling day and night

UNDER natural photoperiods—alternating periods of lightness and darkness—breeding stocks of sugarcane flower at widely different times. At the U.S. Sugarcane Laboratory in Houma, La., as at most cane-breeding centers throughout the world, daylength is controlled to induce simultaneous flowering.

Breeders agree that age of cane, temperature, soil moisture, and soil fertility at the time of inductive daylength interact with the photo-period to enhance, retard, or prevent growth.

All photoperiod research is intended to synchronize the flowering of diverse genetic material to produce superior crosses. Specialized photoperiod regimes vary from short-, intermediate-, or long-day exposures and are amended to include fixed, increasing, or decreasing daylengths or their combinations. Research goals are greater resistance to diseases and insect pests, higher yields of cane per acre, more sugar per ton of cane, improved cold tolerance, adaptability to mechanized harvesting, and longer and better ratooning or growth capacity.

At the Houma laboratory scientists are manipulating photoperiodism to make crosses between selected clones of *Saccharum spontaneum* and *S. officinarum* L. and interspecific hybrid *S. spontaneum* and *S. officinarum* L. These newly evaluated *S. spontaneum* clones are much more resistant to diseases and cold than those first used as nonrecurrent (wild) parents in India and Java, from which modern commercial canes are derived.

"By inducing parent canes to flower earlier or later, we made 41 bi-parental crosses that would have been impossible under natural conditions," said agronomist P. H. Dunckelman, who is working with research technologist Meinrad A. Blanchard.

The scientists planted single-bud cuttings of selected parental varieties in flats of sterilized soil in the greenhouse. Two months later, they were transplanted to 10-gallon cans on carts in the breeding greenhouse. In early spring the cans were moved from the greenhouse onto outdoor racks and a few months later onto the carts of the photoperiod house. Sunlight was used for all treatments. Each can culture was fertilized and special efforts, not always successful, were made to maintain proper soil moisture. Drainage was sometimes difficult to control.

In experiment 1, 17 of 24 commercial varieties were induced to flower 4 to 6 weeks earlier by a declining 1 minute per day daylength for 50 days.

In experiment 2, 17 commercial breeding canes also flowered earlier when subjected to a fixed daylength of 12 hours and 25 minutes for 42 days and then put on a declining 1 to 2 minutes a day daylength for 18 days.

In experiment 3, nine early-flowering varieties and one late-flowering variety of *S. spontaneum*, two U.S. varieties, and three mid-season flowering commercial canes were subjected to a fixed 9-hour daylength which inhibited flowering in most varieties. *S. spontaneum* L. Tainan was delayed 54 days.

Controls of most varieties in the experiments were kept on the carts of the breeding greenhouse and protected from night temperatures below 18° C.

In most crosses, interspecific commercial breeding canes were used as female parents and the U.S. breeding canes and wild varieties were used as males. Wild varieties produce a profusion of pollen under controlled conditions.

"New breeding lines started with *S. spontaneum* varieties SES 50, SES 114, and Tainan are possible sources of resistance to mosaic, cold, and the sugarcane borer," said Mr. Dunckelman. Genealogies of seven other new lines also were advanced. □

SUPER SLURPER

Compound with a super thirst

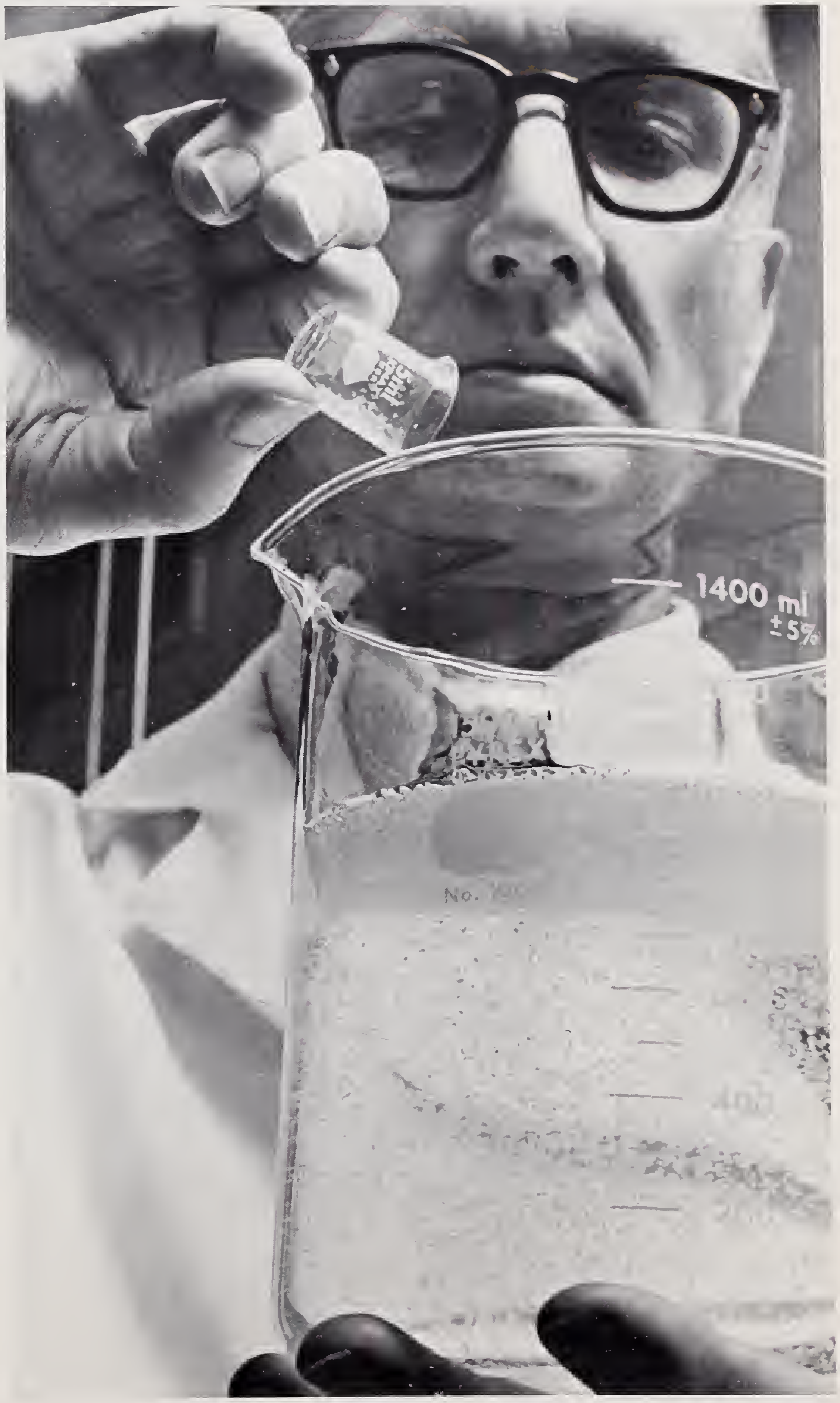
A NEW SUPER SLURPER is expected to intensify the interest of industry, agriculture, and science. Besides having a potentially useful "split personality," the new generation slurper can absorb 2,000 times its weight of distilled water.

The new slurper represents the third research generation of a family of water-laboratory starch products discovered at the Northern Regional Research Laboratory, Peoria, Ill.

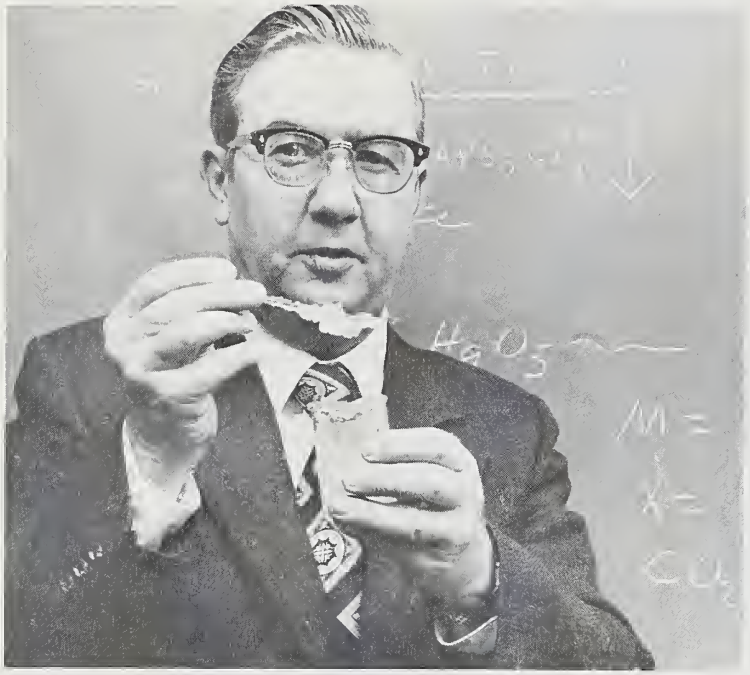
A first generation slurper earned the family name by absorbing 300 times its weight of water. A member of the second generation confirmed the family trait by absorbing 1,400 times its weight of water, half in 30 seconds and most of it in 10 minutes.

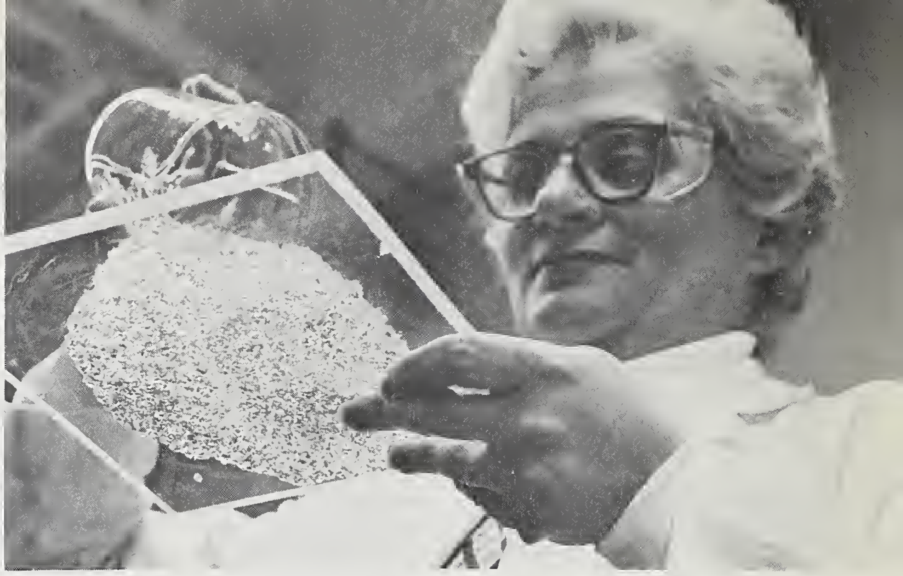
Super slurpers, chemically identified as hydrolyzed starch-polyacrylonitrile graft copolymers, are under study by ARS chemists M. Ollidene Weaver, George F. Fanta, Neil W. Taylor, and William M. Doane and engineer Edward B. Bagley, at the Northern Laboratory. With other scientists in ARS, State experiment stations and industry, they are studying slurpers as absorbents, thickening agents, and soil additives.

The researchers are providing information and samples in response to requests from Europe and Japan as well as all parts of the United States. Super slurper has caught the attention of manufacturers of products from disposable diapers and kitty litter to soil conditioners and seed coatings. More than 50 potential applications have surfaced in several hundred letters of inquiry that have been received by scientists at the Northern Laboratory.

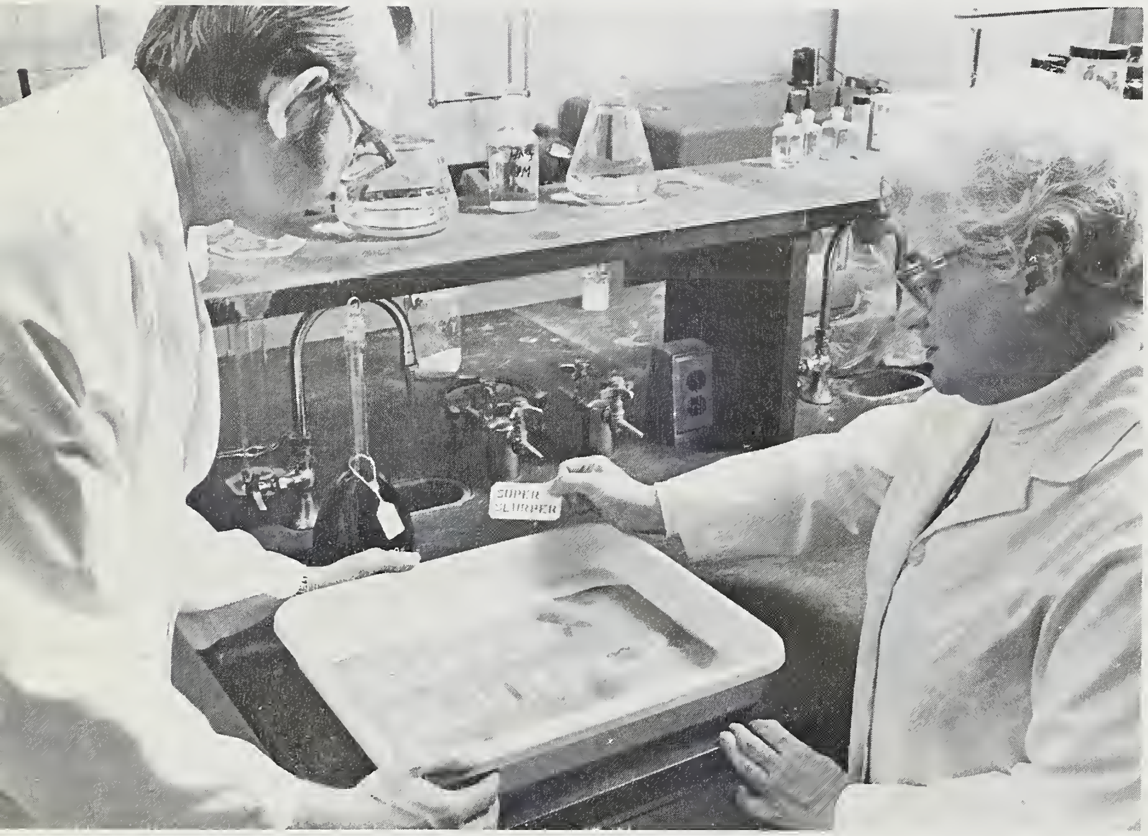


Dr. Doane demonstrates that only 2 grams of super slurper will absorb 1,000 grams of water. In powder or flake form the absorbant congeals the water to the consistency of crushed ice. Later generations of the super slurpers can absorb up to 2,000 times their weight of distilled water (0375R222-15A).





Left: Dr. Russell, initiator of the starch grafting studies at the Northern Laboratory, holds a beaker of congealed water. He says that super slurpers demonstrate that components of annually renewable farm commodities can be used to extend and conserve limited petroleum resources and that those combinations of natural and synthetic materials can have useful properties that neither parent material alone has (0375R220–25A). Above: Glistening like crushed ice, but more solid at room temperature, a mixture of 998 parts water in 2 parts slurper surprises Miss Weaver by not flowing from a smooth, flat surface (0375R223–29).

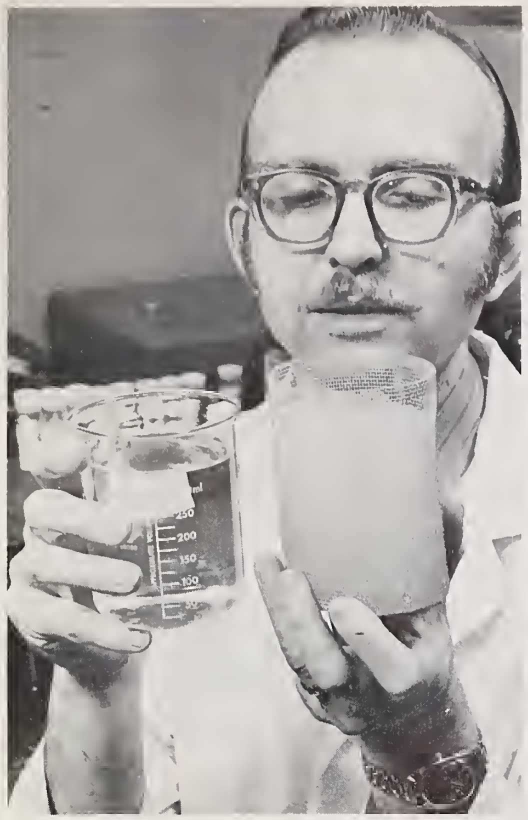


Super slurpers can also be produced in film forms as well as powdered. Dr. Fanta looks on as a film of the compound, originally the size of the stencil held by Miss Weaver, expands three-dimensionally when placed in water (0375R223–8).

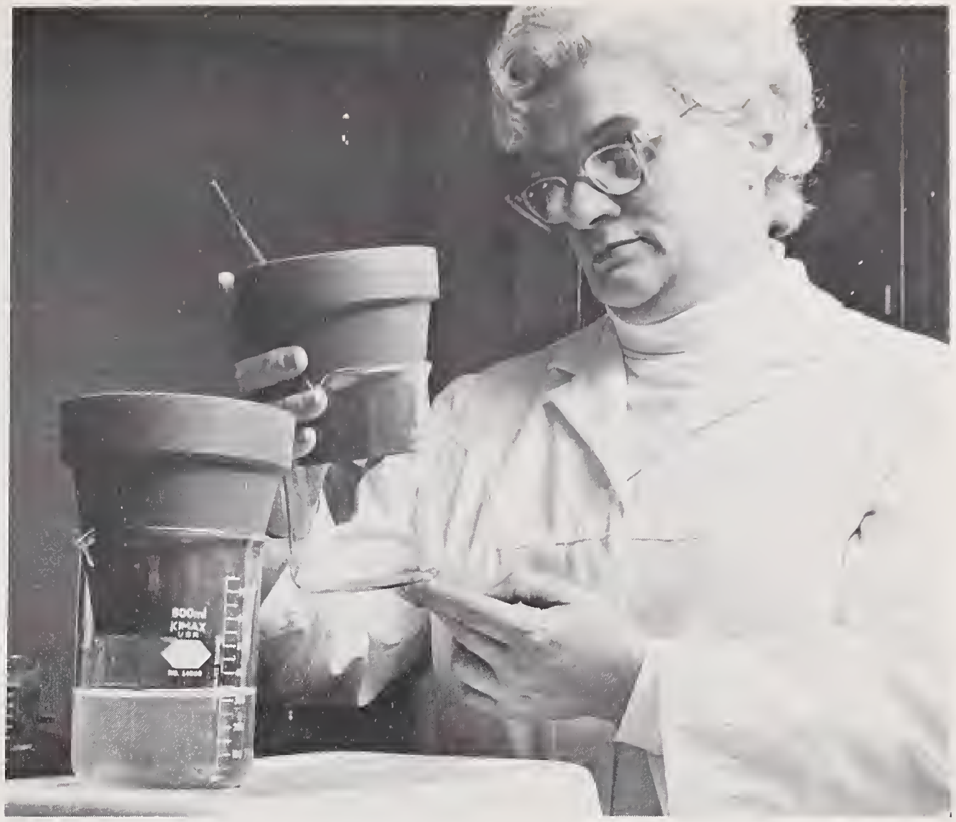
Super slurper III has a "split personality" built in by mechanical treatment. It is a laboratory specimen produced in test tube quantities by Dr. Bagley and Dr. Taylor in basic studies that have been aimed at learning what makes a slurper and how to control it.

Unlike earlier slurpers—which disperse in water to form gels that are difficult to pour—slurper III dissolves, and the solution pours like water. It easily penetrates such porous materials as cloth and sand. When the solution dries and is aged or heated, super slurper III reverts to the family behavior. It forms gel dispersions when water is added again. Slurper III studies show how to make a slurper with a selected capacity of up to 2,000 times its weight of water.

Filling requests for research samples, Miss Weaver and Dr. Fanta regularly make slurpers that absorb 700 to 800 times their weight of water or 55 times their weight of simulated urine. (Simulated urine contains urea, salt, magnesium sulfate and calcium chloride in water.) Against pressure 180 times that caused by gravity, these slurpers have almost 40 times the urine absorption capacity of cellulose fibers.



Dr. Fanta demonstrates that with the help of super slurper a screen wire "beaker" can hold water just as well as a glass beaker (0375R220–36A).



Miss Weaver does an experiment to show one of the potential uses of super slurpers—increase water retention of soils. Sand in the pot on the left held only 50 of 400 grams of water poured through it, while a 500 to 1 mixture of sand and super slurper in the other pot held all 400 grams of water (0375R221–26A).

Cellulose is the main absorbent used in disposable diapers, bed pads, bandages, and surgical sponges. Shortages and rising costs of cellulose are increasing the demand for absorbents that cost less, absorb more, and have less bulk. Bulky materials cause problems in sewage disposal.

What about costs? Estimating the cost of corn starch at 8 cents a pound, engineer Virgil E. Sohns estimates that super slurper could be made for less than 30 cents a pound in a plant with a capacity of 5 million pounds a year.

Dry super slurper can be made as films; thin, cushiony mats; flakes; or powder. When a film takes up water, it expands to a sheet of gel but retains its dry shape. Films of the original slurper, taking up 300 times their weight of water, expanded 33 times in surface area.

Gel sheets contract and become rubbery in dilute acid. They expand again in dilute alkali solution.

Coatings with these properties can be formed on sand grains, straw, wood shavings, all kinds of natural and synthetic fibers, seeds, and other materials where water-absorbent properties would have value. Super slurper can be added in different proportions for different effects to a variety of porous materials like cloth or soil.

Only 1 percent of the slurper (dried in sand) is needed to bind sand firmly enough to be used for molds in metal castings, Dr. Bagley says. As little as 0.1 percent would hold sandy soil surfaces against wind erosion. In either situation, slurper and sand woud absorb and hold more water than sand alone.

Super slurper increased water-holding capacity of sand and greatly enhanced the top growth of oats planted in it in greenhouse tests at Iowa State University, Ames. William D. Shrader, professor of soil management, compared the growth of oats in sand and in a mixture of 1 part slurper to 250 parts sand. He saturated and then drained both the sand and the mixture just before he seeded the oats.

The sand retained only 24 grams of water compared with 317 grams of water held by the sand-slurper mixture. Oats in the sand died 14 days after seeding. The top growth weighed 0.03 gram. By contrast, oats in the slurper-treated sand lived 11 days longer, dying 25 days after seeding. The top growth weighed 0.32 gram.

Dr. Shrader is among more than 700 scientists in agriculture and other industries who have obtained research samples of super slurper from the Northern Laboratory. Other scientists are obtaining samples from General Mills Chemicals, Inc., Minneapolis. General Mills, one of five companies that have licensed a super slurper patent application (Serial No. 456,911), is the only supplier of developmental quantities of the absorbent.

Super slurpers are a branch of the family of starch graft copolymers on which Charles R. Russell, now chief of cereal products research, started research at the Northern Laboratory early in the 1960's. Grafts of acrylonitrile to starch were studied extensively by Dr. Russell, chemists Lewis A. Gugliemeli and Robert C. Burr, and Carl E. Rist, now retired, and others. □

Turf clippings yield high quality feed

HIGH QUALITY poultry feed—rich in xanthophyll and carotene—can be prepared by dehydrating turf farm grass clippings. These clippings are usually discarded as waste after each mowing to prevent insects or diseases from developing in the turf.

Scientists at the Western Regional Research Center, Berkeley, Calif., have run a series of dehydration experiments on clippings from bent and blue grasses. Low dehydration temperature, as well as the short time required for drying the grass, results in only moderate loss of carotene (1 percent) and xanthophyll (1 percent).

To produce optimum drying conditions, the outlet temperature in the dehydrator is varied from 220° to 270° F. and, depending on the treatment, drying times are 2½ or 3 minutes. By increasing the exhaust fan speed, it becomes possible to increase both meal moisture and xanthophyll stability.

Due to the high initial xanthophyll content of the fresh grass (over 500 milligrams per pound), and its good retention during drying, the dried product is very high in pigmenting xanthophyll. The high protein (25 percent) and low fiber (20 percent) of the dehydrated meal also help to make it a good quality poultry feed.

Since much of the turf grass is grown over a short season, it may be necessary to store the meal for several months prior to feeding. Chemist Arvin L. Livingston points out that the retention of carotene and xanthophyll during storage can be increased by the addition of the antioxidant, ethoxyquin, prior to storage. In one storage test with dehydrated meal (2.4 percent moisture) and ethoxyquin, about 85 percent of the carotene, and about 75 percent of the total xanthophyll, was retained after 12 weeks at 100° F.

The Center conducted this research with the cooperation of the Princeton Turf Co., Hightstown, N.J., the Warren Turf Nursery, Suisun, Calif., and the Cal Turf Nursery, Camarillo, Calif. As a result of this research, Cal Turf and Warren Turf are operating grass dehydrators at Camarillo, Santa Ana, and Suisun, Calif.

One large turf farmer near Denver, Colo., is planning to integrate his turf operation with a new 200,000-bird poultry operation. Besides salvaging the grass clippings for feed, he will be able to recycle the manure produced by the chickens for fertilizing his turf.

Because agricultural byproducts intended for animal feed must meet government regulations on pesticide residues, these companies have developed turf production systems that avoid the use of any pesticide prohibited from animal feed. In addition, the dehydrated turf grass clippings are monitored to assure compliances with regulations. □

Increasing dairy cattle production

DAIRY HEIFERS fed at relatively high rates of nutrition reach puberty as young as 6 to 8 months of age and can be successfully bred at that time.

Israeli research has proved that these bovine child brides can not only produce a healthy calf, they can also give a reasonable amount of milk. In the United States dairy heifers are usually bred at 15 to 17 months of age.

Although the Israelis were able to successfully breed heifers at 6 to 8 months—even at 4½ months on the highest plane of nutrition—they recommend a delay until 11 months.

ARS-cooperating scientist Ronald D. Plowman, Logan, Utah, says U.S. dairymen could adopt the same practice with less total feed to produce the same amount of milk and with less time required to bring animals into production.

"The Israelis," he says, "found that although milk production in early breeders during first lactation is decreased compared to heifers bred at 15 months, the additional costs of rearing caused by delayed breeding are much higher than the returns from additional milk yield.

"This slight loss in first year milk production was offset in second and later lactations by production that was equal for early and late bred heifers," Dr. Plowman says. "In fact, early bred heifers ultimately produced more milk per day of life than late bred heifers. Also, survival rate and rebreeding production were equal or similar for both."

Up to 11 months, daily weight gain for heifers on a low plane of nutrition was over 1.2 pounds; for heifers on a high plane, over 1.6 pounds. This higher level of gain approximates the desired gain stated in the *Nutrient Requirements of Dairy Cattle*, published by the National Research Council. On the high plane, first estrus appeared at 252 days; on the low plane, 341 days, about 3 months later.

The Israeli investigation also studied difficulties in calving which increased with earlier breeding because of the relatively heavy live weight of offspring as compared with the weight of their dams. The scientists solved this problem by choosing sires known to produce smaller offspring at birth.

This study was conducted at the Institute of Animal Science, Bet Dagan, Israel, under the direction of Dr. J. Kali and Dr. S. Amir. □

Separating the good from the bad

The close-up photo (right, PN–2887) of the 10-bar experimental separator (above, PN–2886) shows good quality beans sliding along the polyfoam curtain, while odd-sized beans, stones, and other rough, foreign material run under the curtain and are trapped on the right side.

CONSERVATION is the watchword of the seventies. Everyone knows we must not waste natural resources, or the products of these resources. It is a matter of concern, therefore, that in meeting required crop seed quality standards with typically available technology, up to 50 percent of our good seed was lost. New technology can bring this waste to an end.

Crop seed as it comes from the field contains various contaminants, such as dirt, rocks, and weed seed. Separating the good seed from these contaminants is called "seed cleaning." The inefficiency of current separating devices causes much good seed to be lost in processing operations.

ARS agricultural engineer Joseph K. Park, Corvallis, Ore., has developed a friction separator that has made almost complete separations of every seed-contaminant mixture tested, including mixtures that could not be further separated by present machines.

Basically, the friction separator separates rough materials from smooth. To date, it has been used primarily to remove dirt and rocks from beans, although it is applicable to other seed crops. Over 99.5 percent of the dirt and 95.0 percent of the rocks were removed from the tested bean mixtures.

The friction separator consists of a feeder, a conveyor belt with a standard nylon carpet surface, and a pair of parallel bars set at an angle across the carpeted belt.

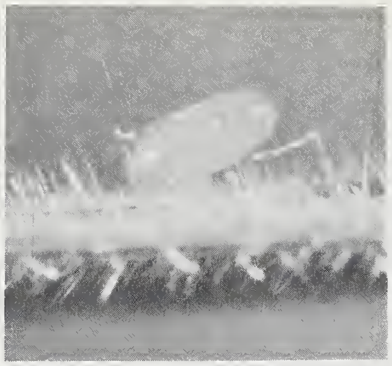
There is an adjustable gap between the bar closest to the feeder and the surface of the carpeted belt. A strip of polyfoam is attached to this bar so that it forms a curtain between bar and carpet. Any flexible material such as rubber, or weather stripping, could be used instead of the polyfoam to form this curtain.

A stream of beans mixed with contaminants is fed onto the moving carpet just ahead of the polyfoam bar. The carpet carries the mixture to the polyfoam curtain. The good beans, being smooth, slide diagonally along the face of the curtain into a conveyor trough. Dirt, stones, broken-shelled beans, and other types of contaminants, being rough, roll under the curtain, are intercepted by the second solid bar, and are diverted across the carpet into a second conveyor trough.

The machine can be adjusted to handle seeds of various sizes and textures. The friction separator has worked well with all types of beans tested, ranging from lentils to giant lima beans, as well as both smooth and wrinkled peas. Mr. Park says the machine will effectively separate other mixtures of rough and smooth particles, including other seed and contaminant mixtures.

Using a friction separator possessing 10 pairs of bars, Mr. Park has cleaned medium-sized beans at feed rates above 400 pounds per hour. A nearby commercial machine with 20 pairs of bars has cleaned 1,000 pounds of beans per hour.

Presently there are four commercial friction separators now in use in this country—three in Idaho and one in California. In addition, a processing plant in Idaho has built four such devices. As more companies adopt the friction separator the quality of crop seed on the market should noticeably improve and, perhaps even more important, much less good seed will be wasted. □



***Right:** An adult cereal leaf beetle oviposits on the leaf of C18616, a long-pubescent wheat line (0275X152–27). **Above:** Larvae hatched from eggs on long-haired wheats are less likely to survive than those on wheats with short hairs (0275X154–3).*

Cereal leaf beetles vs. long wheat hairs

IT'S LENGTH of leaf hairs, even more than number of hairs, that makes some wheat plants inhospitable to the cereal leaf beetle.

A dense covering of leaf hairs (trichomes), as scientists have long known, interferes with both egg-laying and the survival of cereal leaf beetle larvae (AGR. RES., April 1966, p. 15). Plant breeders accordingly have used wheats with hairy—pubescent—leaves in developing breeding lines resistant to the beetle.

Since its detection in 1962 in southwest Michigan, the cereal leaf beetle has moved mostly eastward and southward into at least 13 other States and Ontario. It has sometimes reduced winter wheat yields as much as 15 percent. The cereal leaf beetle would be a major threat to wheat production if it became established in major Great Plains production areas.

New information on the role of leaf hair length, from ARS studies in cooperation with the Michigan Agricultural Experiment Station, East Lansing, opens additional sources of resistance to breeders. Up to now, they have used wheats with many, long leaf hairs. But they may also take advantage of the moderate resistance of wheats with few, long hairs, especially if these wheats are superior in other characteristics. Leaf blades with few hairs, for example, may trap less moisture than blades with many hairs and thus reduce susceptibility to foliar diseases.

ARS technician Robert P. Hoxie and entomologists Stanley G. Wellso and James A. Webster suggest that long leaf hairs are more of a physical barrier to cereal leaf beetles than short hairs. Long trichomes interfere with egg-laying by adults as well as orientation and feeding of larvae. The larvae must also chew through the hairs to reach the succulent leaf tissue on which they feed, and pieces of the longer hairs may be more damaging to the gut lining of larvae.

The researchers selected five winter and four spring wheats that previously had shown maximum or minimum re-

***Left:** Research technician Robert P. Hoxie places samples of nine lines of wheat in a randomized test cage. Cereal leaf beetles are released in the cage and remain for 72 hours, then the number of eggs on each variety are counted—showing preference or nonpreference for a wheat line (0275X154–26A). **Above:** A cereal leaf beetle oviposits on Genesee wheat, a short-haired wheat variety (0275X153–9).*

sistance to the cereal leaf beetle in field nurseries of ARS geneticist David H. Smith, Jr. The scientists counted the number of hairs per square millimeter (mm) and also measured leaf hair length. They made these determinations at 100 times magnification, along the mid-vein on the upper blade surface about 2 centimeters from the tip.

The wheats were classified generally into three groups for leaf hair density—10, 20, and 30 leaf hairs per square mm—and three leaf hair lengths—50, 125, and 250 millimicrons. Based on the two measurements, Mr. Hoxie and associates divided the nine wheats into six leaf hair categories: few, very short; few, short; few, long; many, long; very many, short; and very many, long.

Two forms of resistance in the nine wheats were measured in two experiments. The researchers counted the number of eggs laid by the beetles in 72 hours on 10-day-old wheat plants and also determined the percentage of newly hatched larvae that survived for 72 hours on wheat seedlings. The number of eggs laid multiplied by the percentage larval survival gave a combined rating for the two forms of resistance in each of the nine wheats.

The combined ratings ranged from 3.933 for susceptible wheats with few, very short leaf hairs to 0.035 for the most resistant wheat with very many, long hairs.

The other wheats had intermediate combined ratings. With one exception, wheats with few hairs showed less resistance than those with many hairs. Two wheats with few, long hairs were significantly more resistant at 0.822 than the wheat with many, short hairs at 1.430. Length clearly had more effect on resistance than density.

Analysis of data confirmed that leaf hair length is more of a deterrent to the cereal leaf beetle than density. An increase in the density of short hairs had about one-half the effect on resistance of an increase in length of few hairs. But it had only one-seventh the effect of an increase in the length of very many hairs. □

Alfalfa reduces nitrate buildups

ALFALFA, a deep-rooted crop, used in rotation with shallow-rooted crops can prevent much of the nitrate that has moved below the normal rooting zone of annual crops from entering and polluting the ground water supply.

ARS soil scientists Aubra C. Mathers and B. A. Stewart, at the Southwestern Great Plains Research Center, Bushland, Tex., in an earlier manure study found varying amounts of nitrate present in the soil profile from the surface to as deep as 6 meters. Water, calcium, and phosphorus were available where the nitrate had accumulated, therefore the researchers with the aid of biological laboratory technician Betty Blair, decided to determine to what extent the nitrate could be removed.

Alfalfa was seeded to plots that in a previous study had received 0, 22, 45, 112, and 224 tons per hectare (ha) of manure or ammonium nitrate at the rate of 224 kilograms (kg) per ha of nitrogen annually for 3 years. The nitrate distribution was determined from samples taken at 30 centimeter increments to a total depth of 6 meters.

The plots were seeded in late summer and four cuttings were made in each of the following two cropping seasons. The first year, alfalfa yield increased as manure treatments increased with the greatest differences in yield recorded during the first cutting and becoming less pronounced with each cutting. Differences during the second year were still evident but were much less pronounced than during the first year.

At the time of seeding, differences in the amounts of nitrate were very large for the different manure treatments. For example, the check plot contained only about 215 kg of nitrogen per ha in the 6-meter profile while the plot with 224 tons of manure per ha contained more than 2,300 kg of nitrogen per ha.

During the first year, soil analysis showed the alfalfa had effectively removed nitrate from the top 1.8 meters of soil of all plots except those treated with 112 and 224 tons of manure per ha. The amounts of nitrate present in those plots were simply greater than could be utilized by the crop and, also, substantial amounts of nitrogen were still being nitrified from the manure.

During the second cropping year, researchers noted removal of nitrate to a depth of 3.6 meters. Only the higher manure treatments did not show a marked decline in the nitrate present below 1.8 meters.

Results of the study indicate that 300 kg per ha or more of nitrate can be removed from the soil by alfalfa during a single year. The depth of removal will depend on rooting depth of alfalfa which frequently roots to depths greater than 6 meters. The study suggests that nitrate is used from any depth where soil water is extracted by the plants. □

Developing aphid-resistant alfalfa lines

Developing germplasm from an aphid-susceptible variety as a source of aphid resistance for breeders of improved alfalfas is not the impossible task that it might seem.

ARS agronomist Edgar L. Sorensen, in cooperation with agronomist Harold L. Hackerott and entomologist Thomas L. Harvey of the Kansas Agricultural Experiment Station, Manhattan, did exactly that in deriving the pest-resistant germplasm KS10 from the variety Ladak. KS10 is a source of resistance to the spotted alfalfa aphid and pea aphid as well as bacterial wilt.

Ladak, which has been a widely planted variety, is susceptible to damage by both aphids. Dr. Sorensen explains that a few resistant plants may exist in a generally susceptible population. Their task was to identify those plants and concentrate the resistance into a form useful to alfalfa breeders.

They initially infested about 50,000 Ladak plants with spotted alfalfa aphids and from this population selected 62 plants that failed to support aphid colonies. They similarly selected 18 from another group of about 500 Ladak plants on the basis of resistance to the pea aphid.

The scientists then grew the 80 selected plants in a seed production nursery under conditions favoring crossing between the two groups of aphid-resistant plants. They planted the seed produced, and from the resulting plants selected 200 with combined resistance to the two aphids. In a third selection cycle, the researchers evaluated the progeny of these 200 plants for resistance to both aphids and also for resistance to bacterial wilt.

Ninety-five plants from the third cycle of selection are the source of the germplasm which, after further evaluation in 10 North Central States, was released as KS10.

The aphid resistance of KS10, measured as the percentage of seedling survival after infestation with spotted alfalfa aphids or pea aphids, is comparable to that of the resistant varieties Kanza, Washoe, and Dawson. KS10 also has about the same bacterial wilt resistance as the highly resistant variety Vernal in a field test at St. Paul, Minn. The parent variety, Ladak, is susceptible.

Average forage yields of KS10 were higher than those of the parent variety Ladak in all North Central Region tests except those in South Dakota. KS10 also exceeded Vernal and Ranger in seed yield in California. □

More improvements for caustic peeling

An improved caustic peeling process for potatoes lessens pollution and uses less lye. It is a modification of a dry caustic peeling process previously developed at the Western Regional Research Center, Berkeley, Calif.

Known as "double-dip," the new process reduces or eliminates the need for gas-fired infrared heaters and permits substantial caustic savings, when compared to conventional lye peeling. Up to a 90-percent saving in caustic has been obtained in laboratory tests.

Last fall the new process went into commercial operation and evaluation in a potato processing plant in Washington. Up to 90,000 pounds of incoming potatoes are being processed per hour.

Here's how the process works. A brief application of caustic is followed by a 15-minute holding period at room temperature to allow the absorbed caustic to soften, but not release, the peel tissue. The second part of the "double-dip" treatment consists of an application of low concentration caustic, and another holding period of 1 to 5 minutes to permit further penetration of caustic through the peel and around surface defects.

Then the dry potatoes pass over rapidly spinning rubber-tipped rollers that remove the lye-softened peels. All of this waste material is recovered rather than washed out into the plant's waste effluent. It is then used for land fill or cattle feed.

In laboratory tests, the process was also shown to be effective for peeling other vegetables and fruits such as sweet potatoes, red beets, carrots, and apples.

Agricultural engineer Charles C. Huxsoll, plant physiologist Merle L. Weaver, and chemical engineer Robert P. Graham developed this process at the Center.

Dr. Huxsoll said, "The amount of lye used is becoming an increasingly important consideration in peeling operations. It is made by an energy intensive process, so as energy costs increase, the costs of making lye also increase. Lowering lye usage also means that the recovered peel waste will have a lower alkalinity, thereby making it easier and cheaper to convert the peel wastes to useful livestock feed.

"Because the 'double-dip' process achieves lower lye use without sacrificing product yield, and without expenditure of more energy at the processing plant, we feel it will be increasingly used by the processing industry." □

Chosen to give the Eighth B. Y. Morrison Memorial Lecture in July is Nash Castro, general manager of the Palisades Interstate Park Commission (0375X233–8).

Eighth Morrison lecturer named

Nash Castro, general manager of the Palisades Interstate Park Commission and former director of the National Capital Region of the National Park Service, will deliver the eighth B. Y. Morrison Memorial Lecture.

ARS will present this lecture in cooperation with the American Association of Nurserymen, Inc., at the centennial celebration meeting of that organization in Chicago, Ill., in July. The Morrison lectureship was established by ARS in 1968 in honor of Benjamin Y. Morrison (1891–1966)—who was a scientist, plant explorer, author, and first director of USDA's National Arboretum, Washington, D.C.

Veteran of a distinguished 30-year career in the National Park Service, Mr. Castro is an administrator and a conservationist who has been and continues to be an exponent for excellence in the environment.

Mr. Castro began his career with the Park Service in 1939. From 1949 to 1955 he served as assistant superintendent of Hawaii National Park. In 1955 he was appointed regional chief of administration and, subsequently, regional chief of operations of the Midwest Regional Office, Omaha, Neb. Yellowstone, Grand Teton, Glacier, Rocky Mountain, and Mt. Rushmore National Memorial were among the park areas administered by the Midwest Regional Office at that time.

During the 1960's Mr. Castro was assistant director, then director of the National Capital Region, Washington, D.C. In 1969 he retired from the directorship to become general manager of the (New York-New Jersey) Palisades Interstate Park Commission, an area composed of 75,000 acres and consisting of 23 parks, including five historical sites.

Born in Nogales, Ariz., Mr. Castro served with the Navy during World War II. He attended George Washington University, Washington, D.C.

Lecturer and author of *The Land of Pele* (1953), a history of Hawaii National Park, Mr. Castro has received the Interior Department's highest honor, the Distinguished Service Award (1966), and the American Scenic and Historic Preservation Society's Pugsley Medal for excellence in park management (1970).

Mr. Castro was the first administrator and is now a member of the board of directors of the White House Historical Association. He was the first executive director and is now a trustee of the Society for a More Beautiful National Capital, Inc. He is also on the board of trustees of the American Scenic and Historic Preservation Society and the Rockland County, New York, Center for the Arts. He was appointed national chairman of the Committee for the Lyndon B. Johnson Memorial Grove on the Potomac in 1973.

Morrison lecturers are nominated by representatives of national and international organizations concerned for the earth environment. □

AGRISEARCH NOTES

Insecticide for cotton pests

A new synthetic pyrethroid insecticide, labeled NIA–33297, performed well as a control for some important insect pests of cotton in field studies in the lower Rio Grande Valley of Texas.

Besides showing promise as an effective insecticide for control of the tobacco budworm, bollworm, and boll weevil, the insecticide is considerably less toxic to man than some now in use.

The field tests were conducted at Brownsville by ARS researchers J. W. Davis and D. A. Wolfenbarger, and at Weslaco by J. A. Harding of the Texas Agricultural Experiment Station.

Tests indicated that the experimental insecticide was about 10 times more toxic than methyl parathion to both laboratory and field-collected strains of the tobacco budworm and the bollworm, and about twice as toxic to the boll weevil.

In the Brownsville field test, NIA–33297 was about as effective as methyl parathion, but in the Weslaco test it was definitely superior.

At Brownsville yields were recorded and all treated plots had more seed cotton per acre than the check plots, but the differences were not significant.

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AGRISEARCH NOTES

Blacklight traps for pecan pests

LIGHT in the blue to ultraviolet range, proven a potent attractant for many insects, has been used to successfully control a number of important economic pests of pecans.

Results show a 70-percent reduction in shuckworm infestation over a 3-year test period using blacklight traps at the Southeastern Fruit and Tree Nut Research Station, Byron, Ga.

Presently, control of shuckworms consists mostly of frequent insecticide applications throughout the growing season. The only pesticides used in conjunction with blacklight traps were one mid-season application of a foliar systemic insecticide for aphid control, and five applications of a fungicide at 30-day intervals for disease control.

ARS personnel who worked on this project were agricultural engineer John S. Smith, Jr., entomologist Cecil R. Gentry, and technicians George W. Edwards and John L. Blythe. They put four blacklight traps per acre in an 8-acre orchard at a height of about 15 feet in the pecan trees. The orchard had 81 trees.

During the season before testing began, shuckworm infestation was at 72 percent in the test orchard, and 98 percent in an untreated area maintained as a check.

After two seasons of trapping, shuckworm infestations were reduced to the economic threshhold of 25–30 percent. On the average, producers can afford to live with infestations at or below this level.

During the third testing season, infestation was down to about 14 percent, well below the threshhold. In a production situation, trap density could probably be reduced by growers at this point and still keep shuckworm numbers well below the 25–30 percent level.

Control of the other pecan pests caught in the traps also appeared to be complete because researchers could not attribute any damage to them. The other pests include: pecan bud moth, pecan nut casebearer, walnut caterpillar, and the fall webworm.

The scientists point out that while blacklight trapping can be considered successful based on these test results, further studies are needed on the feasibility and economics of the technique in pecan orchards.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

PROTECT
Use Pesticides Safely
FOLLOW THE LABEL

Soybean herbicide update

AFTER the April issue of AGRICULTURAL RESEARCH Magazine went to press, the Environmental Protection Agency acted on the registration of the herbicide bentazon. EPA has now approved the use of bentazon on soybeans. Both bentazon and metribuzin are now registered for use on soybeans.

Correction: Mexican bean beetle

IN our April issue, the photograph on page 4 is incorrectly identified as an adult Mexican bean beetle. Actually it is of a Mexican bean beetle larvae on a soybean leaf.

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